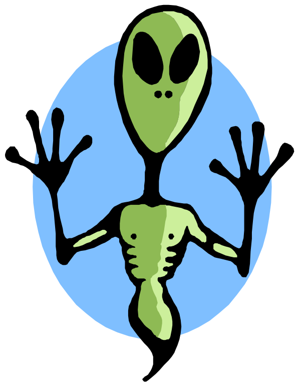
Task Information

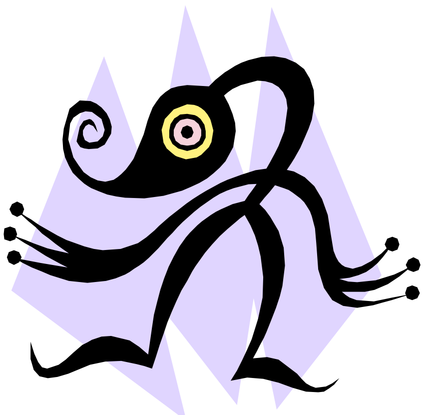
Task 1: *Choose a planet and list five features that describe it.*

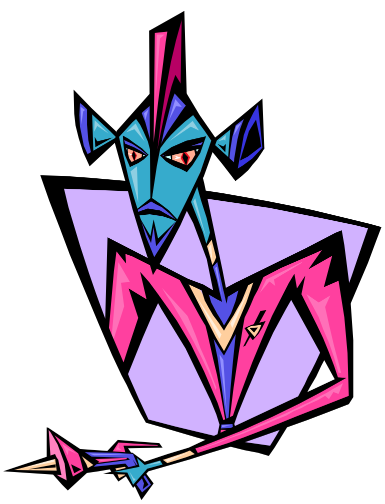
To make things easy we've put together a table of planets and their characteristics. A great activity to do in class after your visit is to consolidate all the students' answers to form a similar table on the blackboard.

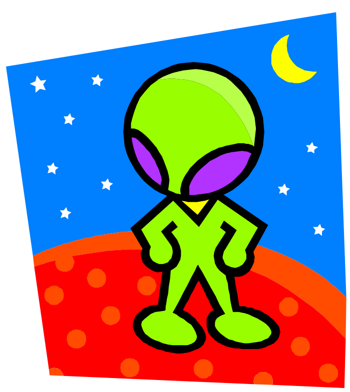
Planet	Colour	Surface	Temperature	Moons	Other features
Mercury	Gray	Dusty and cratered	Hot in the day, Freezing at night	None	Similar to the Moon
Venus	Blue and White clouds, Yellow and Orange surface	Rocky with old volcanoes and ridges	Very Hot	None	Similar in size to Earth. Greenhouse weather.
Earth	White clouds, Blue oceans and different coloured land masses	Water and Rock	Just right	One	Atmosphere with Oxygen, only planet with life!
Mars	Red-Orange with white poles	Dry and sandy	Cold	Two	Sand and rocks. May have once had life. Poles and atmosphere mainly carbon dioxide.
Jupiter	Brown with White and Yellow bands	Clouds - no solid surface	Very cold	Sixteen	Big red storm and other small storms. Large moons. Small ring around planet.
Saturn	Butterscotch	Clouds - no solid surface	Very Very Cold	Eighteen	Big rings around planet. Moon called Titan which is bigger than Pluto and has atmosphere.
Uranus	Green-Blue colour	Clouds - no solid surface	Extremely Cold	Ten	Boring atmosphere. Tipped on its side. Weird moons like Miranda.
Neptune	Blue	Clouds - no solid surface	Extremely Cold	Eight	Bright atmosphere with white clouds. Dark storm. Moon Triton has cantaloupe region.
Pluto	Maybe White, Gray and Purple?	Snow and ice?	Freezing	One	Small distant planet. May have been a Neptunian moon. Moon is nearly same size as planet.

The second part of the task asks the children to describe or draw an alien that would be best suited to these conditions. This is really up to their creative thinking, however they must remember that factors such as temperature, sunlight, surface, etc. will limit what an alien looks like. For example a woolly or furry alien would live on Pluto, but not on Venus. Feet are useless on Jupiter because it has no surface, and aliens may be taller on Mercury than on Earth because it has less gravity.

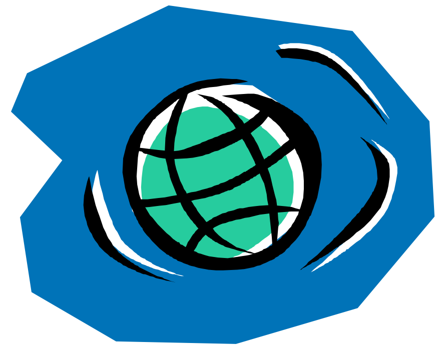








Task 2: Calculate your age on the 'How old are you?' exhibit for the planets listed below.



Each of the planets orbits around the Sun at a different speed. This is because the gravity felt by Mercury is stronger than that felt by distant Neptune, so it must travel faster in its orbit to avoid being 'swallowed' by the Sun. Our planet, Earth, travels at over 107 000 km/hr around the Sun and it takes 365.25 days to complete an orbit. We call this a year. Each year you celebrate a birthday that indicates how many times the Earth (and you!) has orbited the sun since you were born. But what would you do if you lived on Mars? Mars takes 687 days to orbit the Sun once (one Martian year). This is roughly 23 months, or two Earth-years. So for every one Martian-year, two Earth-years (and two Earth-birthdays) would have gone by. On Mars, you would celebrate your birthday only half as often as your 'Earthly' cousins. It would also mean that you finish school at age 9, raise a family as early as 10 and retire at age 30.

On Venus it takes approximately 224 days for the planet to rotate (one Venusian day) and 225 days to complete one revolution around the Sun (one Venusian year). Since the Venusian day is nearly the same as one Venusian year, there is only one day in a year! That means you celebrate **New Years Day and your birthday** on the same day.

To calculate your age on other planets, first calculate your age in Earth days. To do this, multiply your age (in years) by 365. Choose the planet you want to live on and divide your age (in days) by the planet's year (in days). To convert it into months, multiply the result by 12.

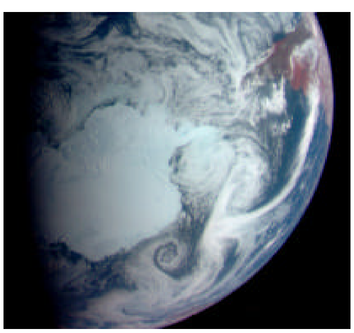
Task 3: Look at some of the atmospheres of the planets in the centre. Use the *Turbulent Orb* exhibit to try and recreate these patterns. Which patterns of which planets were you able to simulate?


Turbulent Orb

Smoothly curving flow-lines in the Turbulent Orb are given the name Laminar Flow. Small vortices and chaotic patterns are called Turbulent flow. A typical diagram would look something like the diagram to the right.

Attempts to model such patterns are being made using what's called Chaos Theory.

Three of the large gaseous planets of our solar system (Jupiter, Saturn and Neptune) have amazing turbulent atmospheres. Even the atmosphere surrounding our Earth is a series of constantly evolving spirals and swirls.


Swirling cloud on Earth


Swirling clouds on Jupiter

Meteorologists, climatologists, and oceanographers study the movement of gases within our atmosphere and oceans. Spacecraft such as TOPEX/Poseidon monitor the patterns of currents within the world's oceans. This helps them create models of the oceans and atmosphere that can then be used in computer simulations. By creating models of our Earth's oceans and atmosphere, we can obtain a greater understanding of the processes that influence global climates.

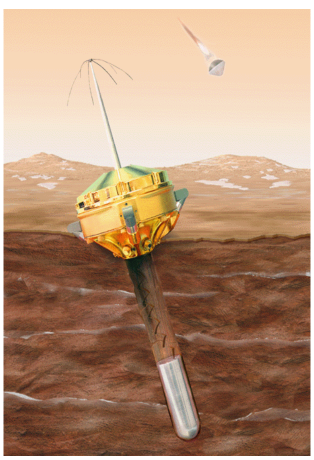
Task 4: Draw a line between the planet and the spacecraft that would be best to explore it. Find an example of each type of craft in the centre, and write out where it is going or has been.

Each planet has its own unique characteristics, as we found in Task 1. Therefore, some spacecraft will be suited to particular targets. In theory it would be possible for all spacecraft to land, sample or probe each target, but the answers given are the most practical.

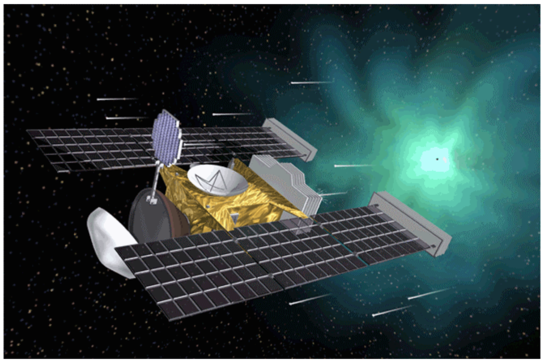
Landers

Landers need some form of solid surface to land on. This rules out Saturn. There are plans to land a spacecraft on the surface of a comet, but due to the comet's small size and unknown surface characteristics it would be hard to guarantee its safety upon landing. Examples of landers are: Rangers on the Moon; Viking and Mars Pathfinder on Mars; Pioneer 13 on Venus.

Probes

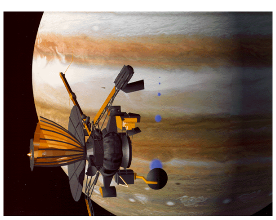


Probes are suited to all locations. They may be a parachuting probe, such as that used with the Galileo mission to Jupiter, or be hard hitting projectiles like Deep Space 2 targeted towards Mars. A probe's instruments can send back information on the atmosphere as the probe gently parachutes down, or pierces the surface to reveal information about sub-surface layers. Examples of probes are: Surveyor on the Moon; Galileo at Jupiter; Deep Space 2 on Mars.



Sample Return

A Sample Return mission would consist of collecting samples of extraterrestrial objects and returning them to Earth for study. Like probes, sample return missions would be possible for all three objects. The most likely is the comet, which is currently being undertaken by the NASA's "Stardust" mission. In 2004 Stardust will pass through a comet's coma (the gas region surrounding the hard comet nucleus) and capture pieces of comet dust. These will be returned to Earth. A sample return mission from Mars is being planned for 2005-8. Martian materials will be collected and placed in a craft that will then be launched from the surface of Mars and returned to Earth**--a highly technical feat**. To bring a sample of Saturn back would require a toughened spacecraft capable of travelling through part of the Saturnian atmosphere and surviving its strong radiation field. **While this is technically possible, it may not occur for many years yet**. Examples of sample return missions are: Apollo to the Moon, Stardust to a comet, Mars Surveyor to Mars (as yet to be launched).



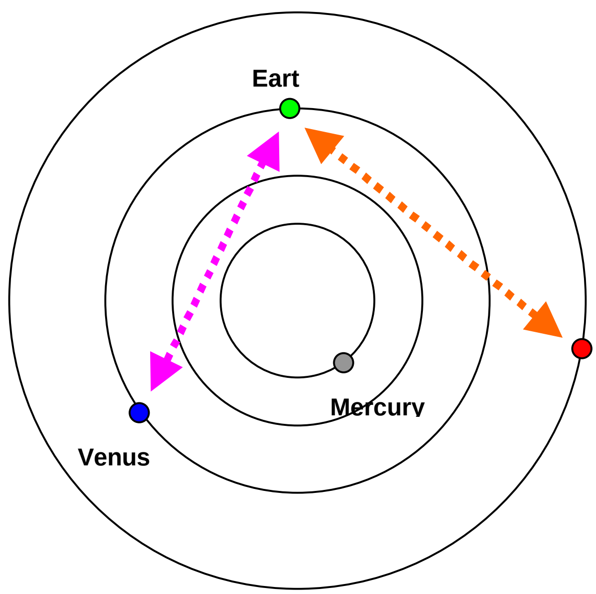
Orbiters

An orbiter is used to map the surface of an object, observe its environment, or search for minerals and water etc., all remotely from orbit. The planets Saturn and Mars are ideal candidates for an orbiter (see Cassini and Mars Global Surveyor). Orbiting a comet however would be difficult because it has a very weak gravitational field. Examples of orbiters are: Magellan at Venus, Viking at Mars, Galileo at Jupiter, Lunar Prospector at the Moon.

Task 5: Mark on the diagram below the relative positions of Venus, Earth and Mars. Using the scale shown below and a ruler, calculate the distance between each planet.

Each of the planets of the solar system orbit the Sun at different speeds and distances. This means that the positions of the planets at any given time is most likely unique. The position of planets relative to each other influences greatly the design of deep space missions. Gravitational flybys depend on a planet being at almost the same point in space as the spacecraft at the same time. As an example, the Voyager 2 mission to the outer planets was only possible because of the **configuration** of the gaseous planets, **which was** so unique that it will not occur again until the middle of the 22nd century!
The timing of spacecraft communications is also dependent on planetary positions. If a message is to be sent to another planet, such as Mars, and a reply is required, then factors such as distance and interference must be considered. Since all of the planets orbit around the Sun, the distance between each planet is constantly changing. Also at times, one planet may pass behind the Sun when viewed from another planet. Since electromagnetic waves (like radio waves) cannot travel through, or bend **significantly** around the Sun, the message cannot be delivered.

Here is an example answer showing how we calculated the distance to Venus and Mars and the time that an electromagnetic signal would take to travel between them.



Measured Distance between Venus and Earth is 45 mm.
This is equal to 270 million km.
Measured Distance between Mars and Earth is 47 mm.
This is equal to 282 millions km.
Venus and Mars are about 312 million km apart.
How long would a radio signal traveling at the speed of light (300 000 km/s) take to travel these distances?